exposed to diffuse daylight alone the amount of photosynthesis is a measure of the light, and it varies with varying light only when the amount of carbon dioxid in the atmosphere is artificially increased and the temperature is kept high. If not, photosynthesis is limited thereby and is constant though the light vary. Isolated leaves may rise more than 10° C. above a bright mercury thermometer in the sun, a result quite at variance with BROWN and ESCOMBE'S results,[7] which, however, were calculated, not observed. Further study of this point is needed.

At normal temperature leaves are not able to utilize the full amount of energy absorbed; helianthus could reach its maximum at 29° C. with about 68 per cent. full sunlight and cherry laurel with about 36 per cent. When light is the limiting factor equal intensities produce equal photosynthesis with leaves of most various structure and type. At low temperatures leaves as different as helianthus and cherry laurel have similar photosynthetic maxima, but at high temperatures these diverge. Thus at 29.5° C. the former can fix twice as much CO_2 as the latter, requiring twice as much energy to do it, of course. The essential difference in the photosynthetic activity in different leaves lies, then, in that they have different coefficients of acceleration of this function with increasing temperature. So in nature it appears that the low pressure of CO_2 (entailing slow diffusion after solution at the surfaces of the leaf cells) and the low temperatures are the serious impediments to food making.—C. R. B.

Root tubercle cultures.—Much interest has been excited during very recent years by work done in the Department of Agriculture concerning soil inoculation with various root tubercle bacteria. Widespread and rather unfortunate notoriety has been given to the work by numerous popular magazine and newspaper articles, and the impression has been gained by the public that nearly all knowledge concerning the root tubercle is to be attributed to the recent investigations conducted in the Department. This popular impression is of course erroneous. The two distinctive contributions to this subject claimed by the workers in the Department of Agriculture were that the nitrogen-gathering ability of the bacteria was heightened by new cultural methods, and that a method of transportation in dried condition, upon cotton, had been devised, whereby pure cultures could be distributed readily to farmers.

Much skepticism has existed concerning the possibility of practically heightening the nitrogen-gathering power of the bacteria, and in a recent bulletin[8] HARDING and PRUCHA claim to have demonstrated by an examination of eighteen of these cotton cultures that such packages are worthless for practical purposes since the organisms are unable to survive upon the cotton or survive in such small numbers as to be practically valueless. "Substantially identical results upon six of these packages were obtained in five separate laboratories," and the reviewer may add that similar results were obtained in his own

[7] See BOT. GAZETTE **40** : 473. 1905.

[8] HARDING, H. A., and PRUCHA, N. J., The quality of commercial cultures for legumes. N. Y. Agr. Exp. Sta. Bull. **270**:345–385. 1905.

laboratory. The inability of the cultures to live is attributed to the method of preparation and not to any knavery upon the part of the commercial producers. A test conducted by the authors of this bulletin demonstrated the inability of the organism to survive to a satisfactory degree upon the cotton. Any intention of opposing the idea of treating the seed of legumes with living bacteria is distinctly disavowed.

It is exceedingly unfortunate that this method should have been given such wide publicity and launched as a commercial enterprise until the question as to its efficiency had been thoroughly tested.—F. L. STEVENS.

Streaming of protoplasm in mucors.—This phenomenon, although very striking and easily observed, has been little studied. The movement was noticed by WORONIN in 1866 in *Ascophanus pulcherrimus*. It was described with considerable detail in a number of species belonging to different genera by SCHRÖTER, writer of the latest account,[9] in 1897, and the conclusion was drawn that the movement was dependent upon osmotic conditions. A careful study was also made by CHARLOTTE TERNETZ in 1900, using *Ascophanus carneus*, and the conclusion was reached that it was due to the local entrance or loss of water. SCHRÖTER has confirmed and somewhat extended the work of his predecessors. For his studies he used *Mucor stol.* (as he invariably writes *M. stolonifer*) and *Phycomyces nitens*. He had better apparatus than his predecessors, and was able to arrive at some conclusions with much certainty. He found that the movement was affected only very slightly by variation in the intensity of light. The action of ether, extremes of temperature, pressure, wounds, variation in amount of carbon dioxid, was similar to that of the same agents when applied to the higher plants. The streaming is found to be due to osmotic action and transpiration and therefore does not occur in a homogeneous substratum, as for instance when the fungus is wholly submerged, or in a saturated atmosphere. The streaming is not a rotation or circulation, as in the hairs of roots and stamens and in the cells of Chara, Nitella, Vallisneria, etc., but a backward and forward-movement, in which the protoplasm, vacuoles, and nuclei participate. Occasionally the acropetal movement is somewhat balanced by a thin peripheral layer of protoplasm without vacuoles setting up a basipetal movement. Usually the movement is toward one end of the hyphae for a longer or shorter time, then stops and starts again in the opposite direction.—J. C. ARTHUR.

Germination and radium emanations.—KÖRNICKE[10] has continued his study of the effect of radium emanations on the germination of ungerminated seeds which have been exposed in both the dry and wet condition. His earlier tests were made with radium bromid contained in glass tubes. In his later study he has used a much more powerful mixture which was contained in tubes having one side of

[9] SCHRÖTER, ALFRED, Ueber Protoplasmaströmung bei Mucorineen. Flora **95**: 1–30. 1905.

[10] KÖRNICKE, M., Weitere Untersuchungen über die Wirkung von Röntgen- und Radiumstrahlen auf die Pflanzen. Ber. Deutsch. Bot. Gesells. **23**: 324–332. 1905.